CNTT-E-143

BASIC ELECTRICITY AND ELECTRONICS

STUDENT HANDOUT NO. 306

SUMMARY PROGRESS CHECK AND JOB PROGRAM FOR MODULE 31-3

JUNE 1984

SUMMARY
LESSON 3

IF Amplifiers

IF amplifiers are commonly found in both receivers and transmitters. IF amplifiers provide the required signal gain and selectivity in superheterodyne receivers such as radio, television, and radar.

An IF amplifier is basically a tuned, high gain, fixed frequency RF amplifier with transformer coupling. Ideally, the IF amplifier will select and amplify with constant gain only the desired signal containing all the information needed for good signal reproduction. Therefore, the ideal IF amplifier should have the rectangular frequency response curve shown in Figure 1.

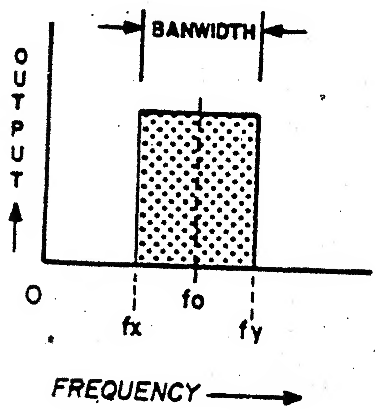


Figure 1

IDEAL IF RESPONSE CURVE

An actual IF amplifier with tuned-primary transformer coupling has a frequency response curve which more closely resembles Figure 2.

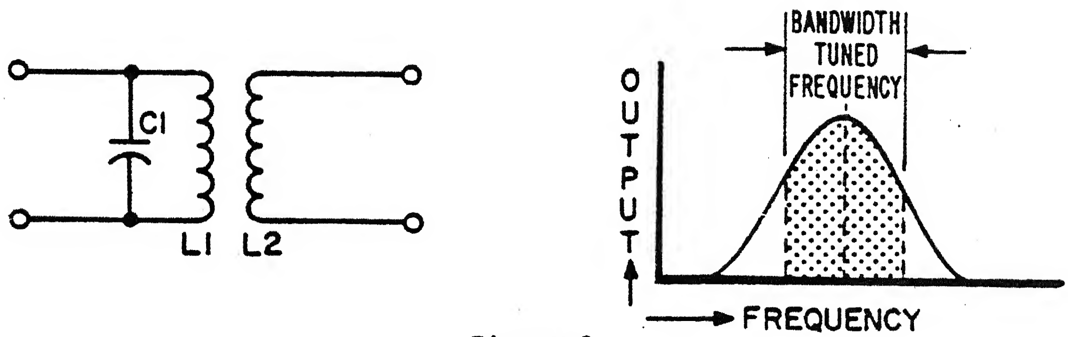


Figure 2

SINGLE TUNED TRANSFORMER COUPLING

There are ways to make the frequency response curve of an IF amplifier resemble the ideal curve and thus improve amplifier operation. One method is to tune all circuits in the signal path to the same frequency, or synchronous tune. A tuned circuit may be added to the secondary of the transformer coupling in Figure 2. If the two tuned tanks are synchronous tuned to the IF center frequency, the resulting frequency response curve is shown in Figure 3.

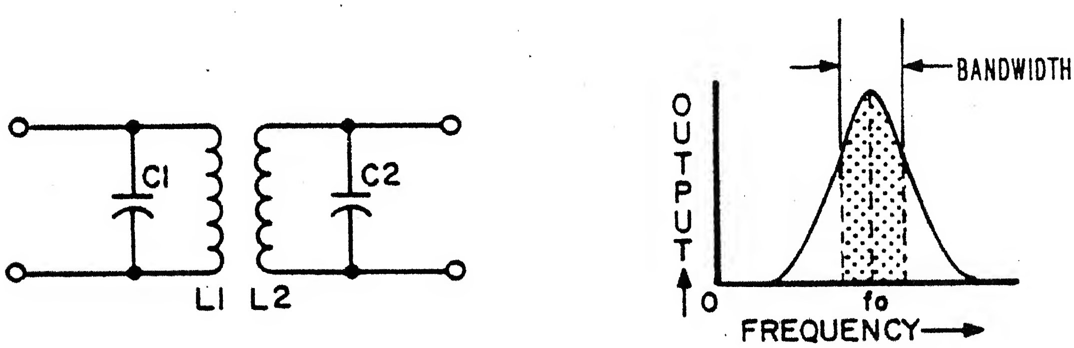


Figure 3

SYNCHRONOUS DOUBLE-TUNED TRANSFORMER COUPLING

In the figure, the bandwidth has become narrower and selectivity has increased.

Synchronous tuning may cause the bandwidth to become too narrow to properly amplify all of the desired signal. For example, television and radar signals require relatively broad bandwidth amplification.

One method to increase the bandwidth of an IF amplifier is to tune each tuned coupling circuit to a slightly different frequency, or stagger tune. The resulting frequency response curve for an amplifier with three stagger-tuned circuits is shown in Figure 4.

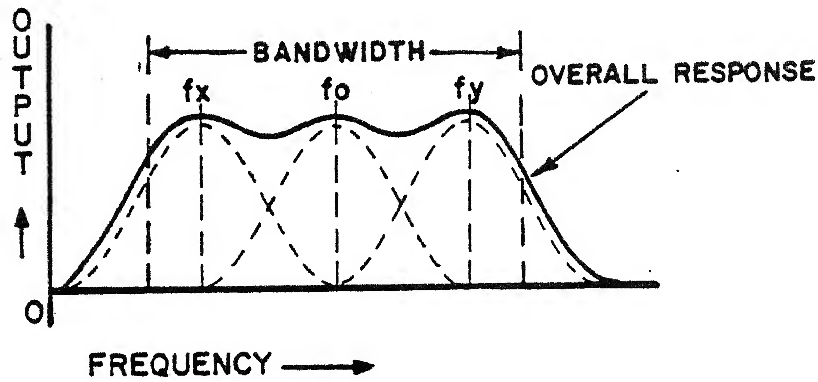


Figure 4

STAGGER-TUNED RESPONSE CURVE

You can see that stagger tuning resonant coupling circuits widens amplifier bandwidth.

Synchronous and stagger tuning can be applied to the operation of a typical common-emitter IF amplifier stage shown in Figure 5.

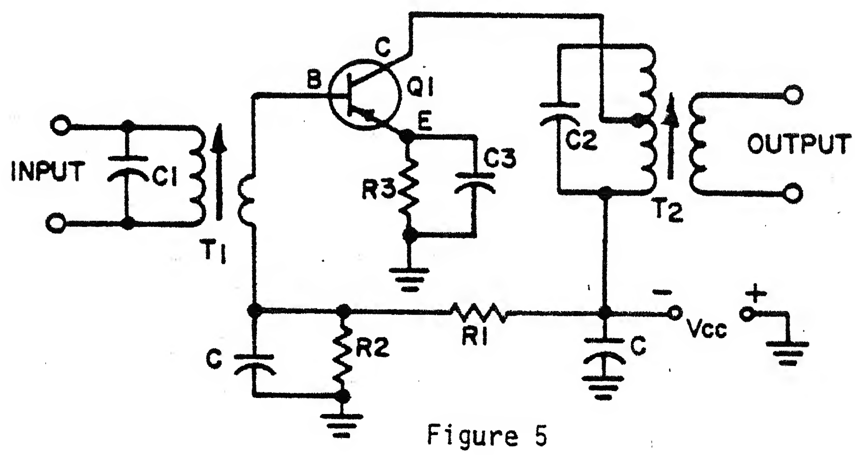


Figure 5

TYPICAL COMMON-EMITTER IF STAGE

This circuit contains two single-tuned interstage coupling transformers. T1 and T2 can be synchronous slug-tuned to provide a narrow bandwidth amplifier with good selectivity. T1 and T2 can also be stagger tuned to increase amplifier bandwidth. Proper tuning in a string of IF amplifiers will produce just about any gain and selectivity required in the receiver.

The NIDA trainer IF amplifier stage is shown in Figure 6.

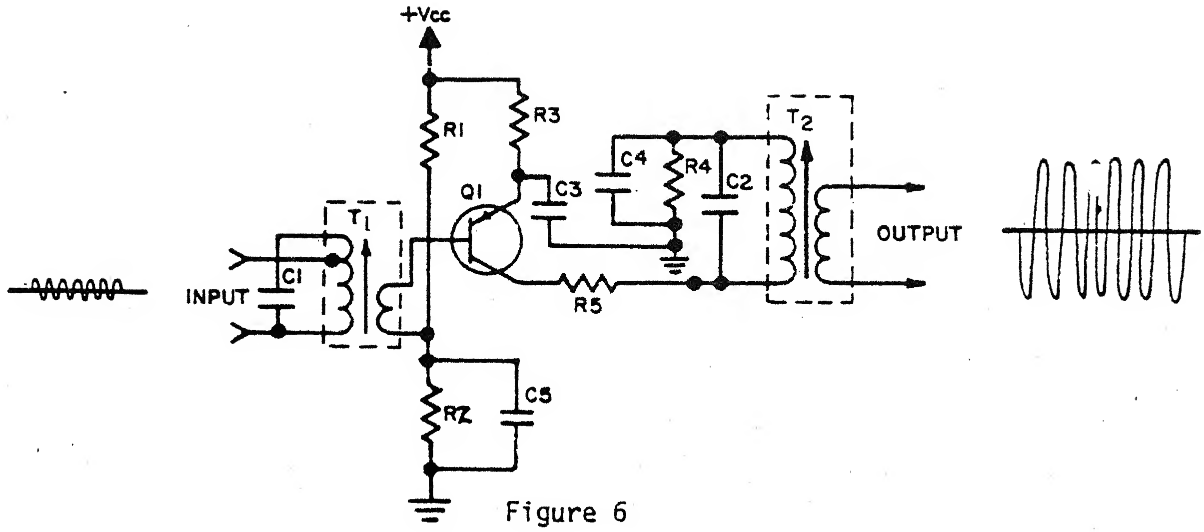


Figure 6

NIDA IF AMPLIFIER

The input signal is applied to coupling transformer T1. The tap on T1 provides an impedance match with the collector circuit in the previous stage. This type of transformer is often enclosed in an aluminum shield to prevent unwanted coupling to nearby wires and transformers. Inductive tuning is done by a tuning slug. The step-down secondary on T1 provides a low impedance match to the Q1 base circuit. R1 and R2 provide forward bias to Q1.

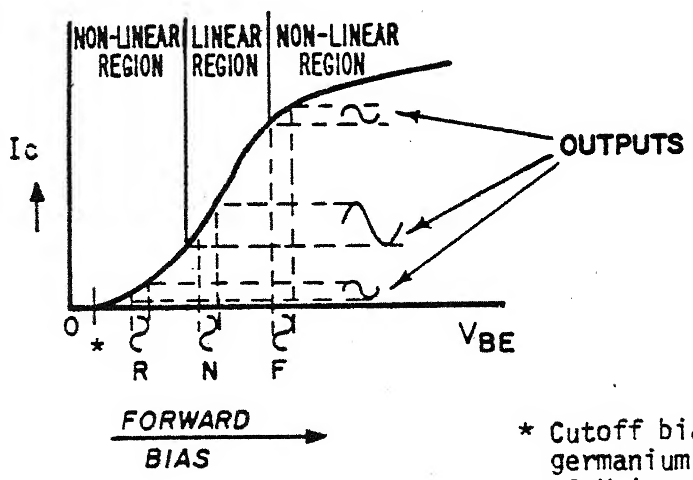
Decoupling capacitor C5 ensures all signal voltage is developed across the secondary of T1, and does not enter the power supply.

In the Q1 collector circuit, the output tank in coupling transformer T2 is tuned to the operating center frequency of 10.7 MHz. C4 and R4 are decoupling components which act to ensure that all signal voltage is developed across the tank, and does not enter the power source. R5 reduces the tendency for strong signals to forward bias the collector-base junction of Q1 which might cause oscillation.

IF amplifiers are usually cascaded to perform their function in a receiver or transmitter. As the number of cascaded amplifiers increases, the gain may become high enough to cause one or more amplifier stages to be overdriven. Severe signal distortion would result as the design capabilities of the circuit and power supply would be exceeded. Therefore, some type of gain control is needed.

The amount of forward bias on the transistor's base-emitter junction (V_{BE}) affects the static operating level of the transistor which, in turn, affects the amount of gain. The transistor produces a reasonably constant gain within a certain bias range called the linear operating region for the transistor. When the forward bias is significantly above or below the linear region, the transistor is operating in the non-linear operating regions. In these regions, the transistor produces lower gain and, with large signals, possible distortion.

The relationship between bias, conduction, and gain are found in the transistor characteristic curve in Figure 7.



* Cutoff bias(about .1V in germanium transistors and .3 V in silicon transistors)

Figure 7

TRANSISTOR CHARACTERISTIC CURVE

The curve is used to determine the amount of gain related to bias and conduction levels for a given input signal. Figure 7 shows examples of three identical input signals applied to a transistor at bias levels within each of the regions. The amplitudes of the input signals are shown above the region labels. The difference in the resulting output amplitudes demonstrates that gain is reduced by applying forward bias either in the "R" region (reverse bias gain control) or in the "F" region (forward bias gain control). You should note that distortion in the non-linear regions is minimized with small signal levels.

A manual method of controlling transistor gain can be shown for the NIDA trainer IF amplifier stage in Figure 8.

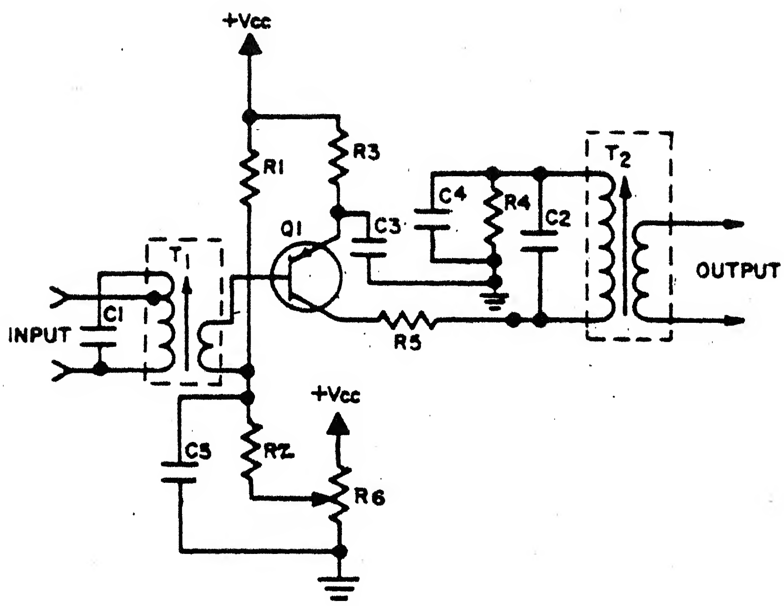


Figure 8

MANUAL IF GAIN CONTROL

In the figure, forward bias is provided by R1, R2, and R6. As the arm of R6 is moved upward, a more positive voltage is placed on the base of Q1 which reduces the forward bias on Q1. If the arm of R6 is moved upward high enough, reverse bias gain control will result.

An automatic gain control (AGC) circuit provides a more constant output from the audio or video equipment in which it is used. Figure 9 shows the addition of an AGC circuit to the IF amplifier stage in Figure 8.

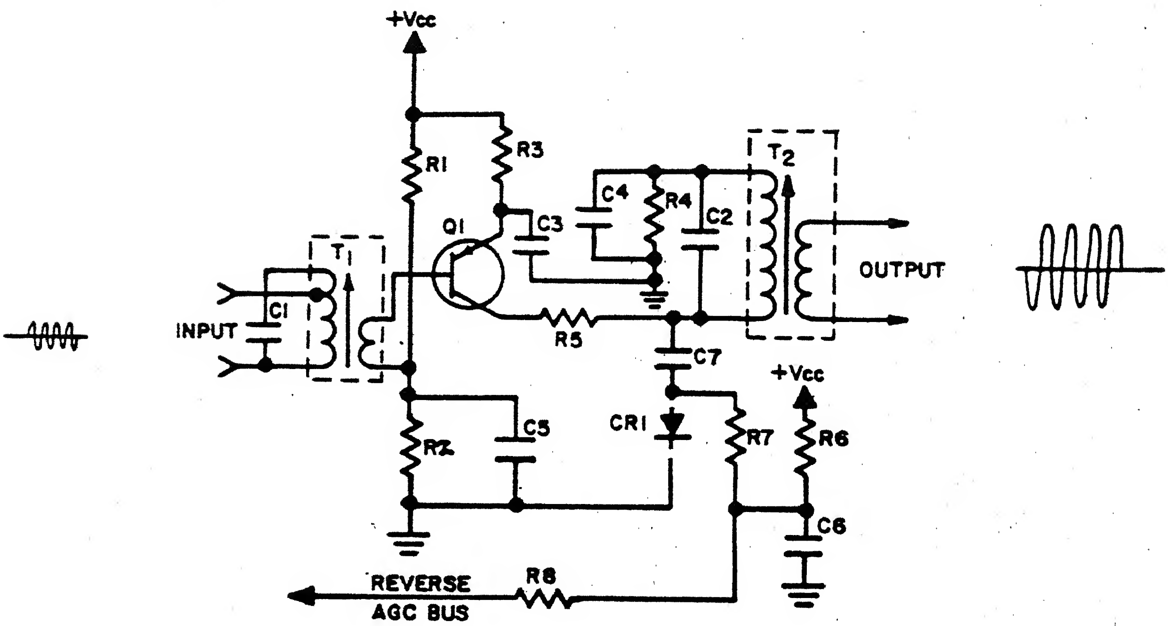


Figure 9

AUTOMATIC GAIN CONTROL (AGC)

The AGC components provide an automatic reverse bias gain control over previous RF and IF amplifier stages. The AGC voltage in a receiver is usually tied to an AGC "bus" which provides feedback to previous stages on the same bus.

In the figure, C7 couples a part of the IF output signal to CR1. This leaves a rectified small-positive average DC voltage at the junction of CR1, C7, and R7. This small positive voltage decreases toward zero as the amplitude of the IF signal increases enough in strength. R6 and R7 form a voltage divider between + V_{CC} and the AGC output voltage. As the positive voltage at the CR1, C7, and R7 junction decreases (but never becomes negative), the AGC output voltage becomes less positive. This lowers the AGC bias voltage on the bus and reduces the gain of previous stages. R8 and C6 filter the AGC voltage to produce a smooth DC level.

You will be using the "S" meter in the NIDA trainer as part of the Job Program for this lesson. The meter is often used in superheterodyne receiver to indicate the strength of received signals, and to help center-tune the receiver. Calibration for "S" meters can be in "S" units, decibels, or some other numerical scale units. In the NIDA trainer, calibration is on a scale from 0 to 10. The "S" meter on the NIDA trainer is found in the second IF amplifier stage.

Figure 10 shows the "S" meter circuit components in the NIDA trainer.

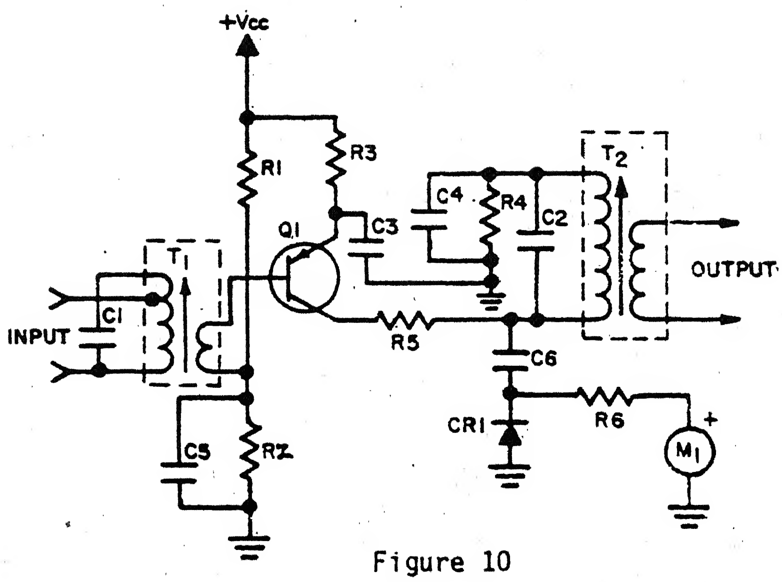


Figure 10

IF AMPLIFIER STAGE WITH "S" METER

For the meter circuit to operate, part of the IF signal is tapped off the Q1 collector circuit. The pulsating +DC voltage across the half-wave rectifier CR1 is applied to dropping resistor R6, and meter M1. The meter pointer indicates the average DC voltage level across CR1.

Technicians often use the "S" meter as a piece of built-in test equipment (BITE) to aid in troubleshooting. When a signal is tuned in, an "S" meter deflection indicates that receiver circuit problems are likely to be located in stages following the meter. If no deflection occurs, receiver problems are likely to be located in stages somewhere leading up to and including the meter circuit.

AT THIS POINT, YOU MAY TAKE THE LESSON PROGRESS CHECK. IF YOU ANSWER ALL SELF-TEST ITEMS CORRECTLY, PROCEED TO THE JOB PROGRAM. IF YOU INCORRECTLY ANSWER ONLY A FEW OF THE PROGRESS CHECK QUESTIONS, THE CORRECT ANSWER PAGE WILL REFER YOU TO THE APPROPRIATE PAGES, PARAGRAPHS, OR FRAMES SO THAT YOU CAN RESTUDY THE PARTS OF THIS LESSON YOU ARE HAVING DIFFICULTY WITH. IF YOU FEEL THAT YOU HAVE FAILED TO UNDERSTAND ALL OR MOST OF THE LESSON, SELECT AND USE ANOTHER WRITTEN MEDIUM OF INSTRUCTION, AUDIO/VISUAL MATERIALS (IF APPLICABLE), OR CONSULT WITH THE LEARNING CENTER INSTRUCTOR, UNTIL YOU CAN ANSWER ALL SELF-TEST ITEMS ON THE PROGRESS CHECK CORRECTLY.

PROGRESS CHECK
LESSON 3

IF Amplifiers

1. IF amplifiers are used in receivers to establish high__________ and provide the desired__________.

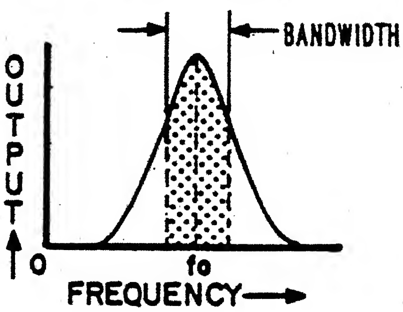
   a. selectivity, demodulation
   b. sensitivity, neutralization
   c. gain, bandwidth
   d. bias, feedback

2. In an IF amplifier__________ tuning widens the bandwidth.

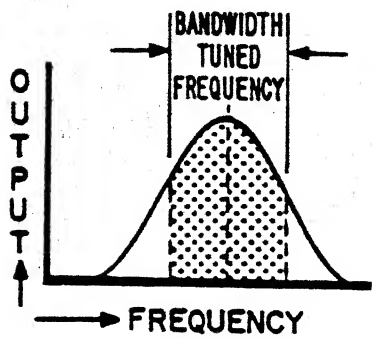
   a. stagger
   b. ganged
   c. variable
   d. synchronous

3. Which diagram best illustrates the frequency response curve for an IF amplifier using synchronous tuning?

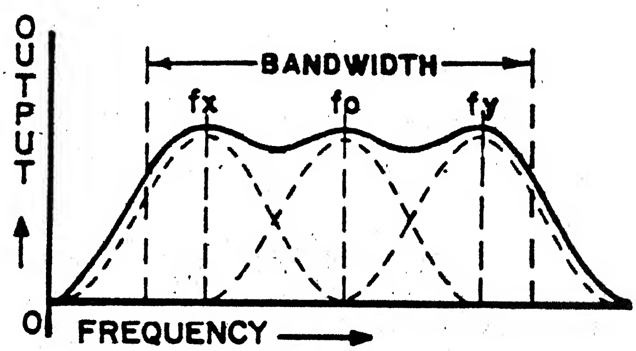
a.



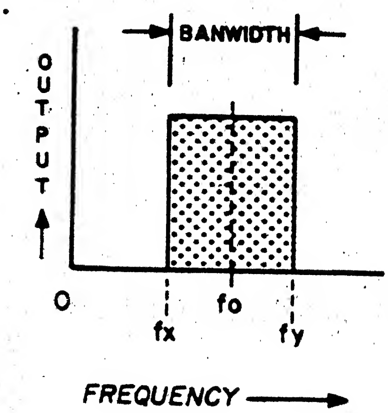
b.



c.

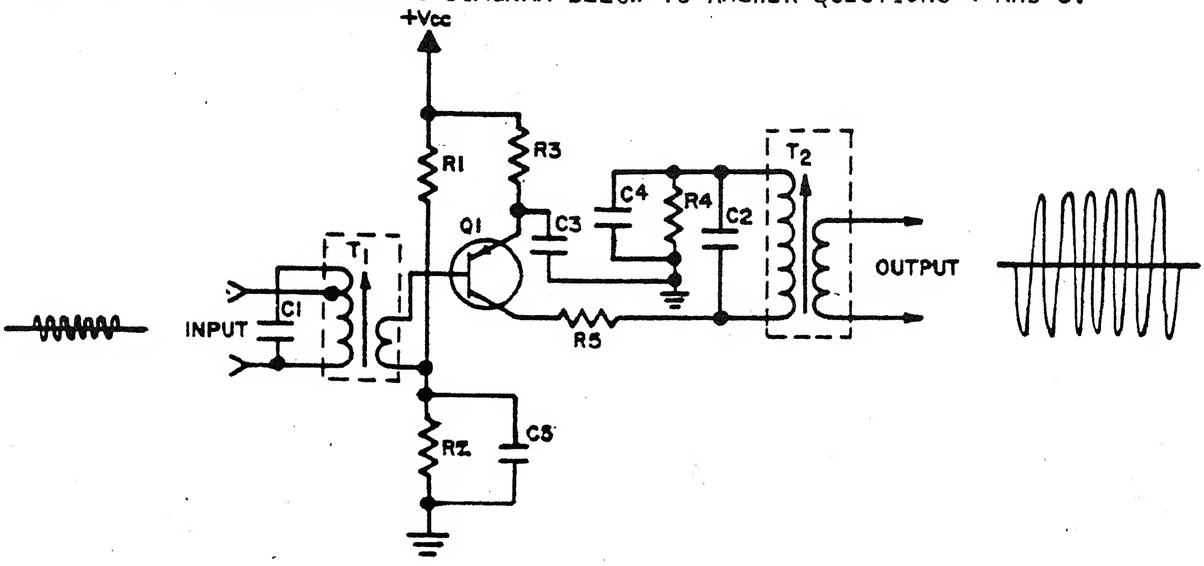


d.



   a. a
   b. b
   c. c
   d. d

USE THE IF AMPLIFIER STAGE DIAGRAM BELOW TO ANSWER QUESTIONS 4 AND 5.



4. T1 and T2 are__________ ______________transformer couplings

   a. untuned broadband
   b. tuned inductive
   c. tuned capacitor
   d. untuned narrowband

5. Which components decouple the signal from the power supply?

   a. R3 and C3
   b. R4 and C4
   c. R2 and C5
   d. R5 and C2

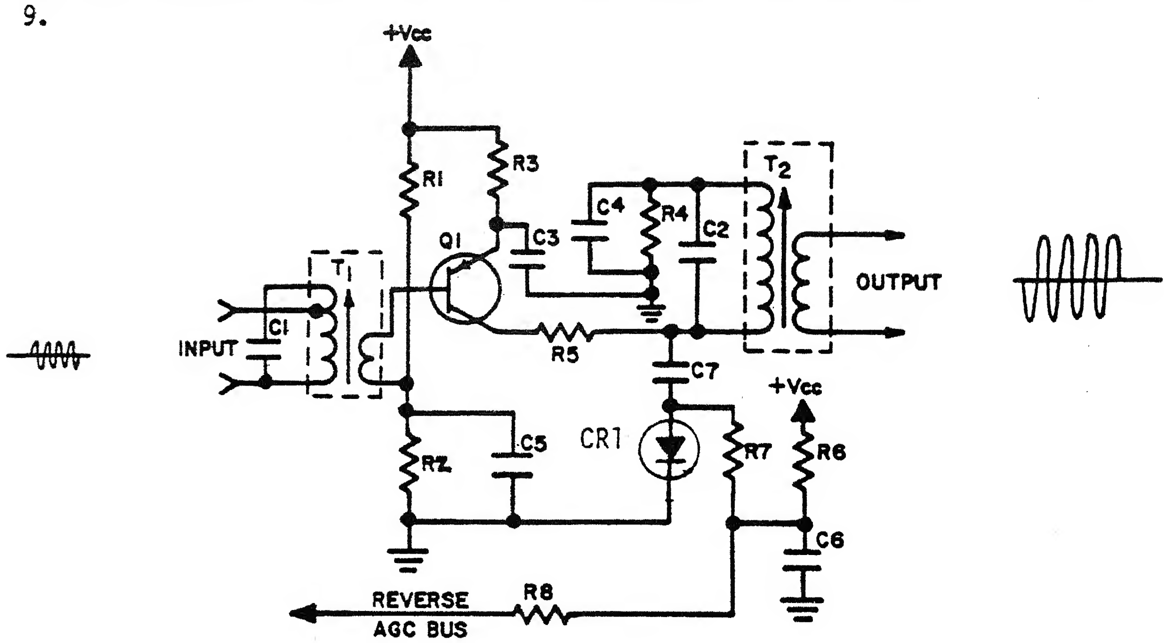
6. An IF amplifier is_____________when the gain causes clipping of the output signal.

   a. neutralized
   b. biased
   c. rectified
   d. overdriven

7. An IF amplifier produces relatively small gain within a_________operating region.

   a. constant
   b. normal
   c. non-linear
   d. linear

USE THE DIAGRAM OF AN IF AMPLIFIER STAGE BELOW TO ANSWER QUESTIONS 8 AND 9.



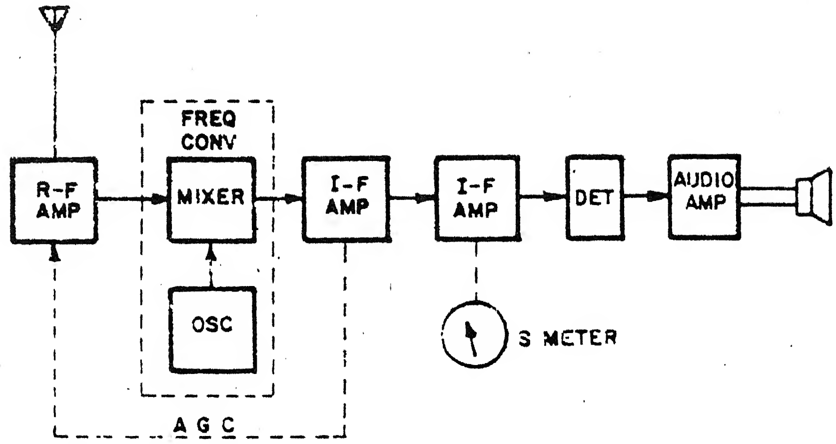
8. If the amplitude of the IF output signal increases high enough, the voltage at the junction of CR1, C7 and R7

   a. remains constant
   b. decreases toward zero
   c. increases toward zero
   d. increases from zero to more positive

9. The AGC circuit in the diagram provides________________bias gain control.

   a. constant
   b. normal
   c. forward
   d. reverse

USE THE BLOCK DIAGRAM OF A RADIO RECEIVER BELOW TO ANSWER QUESTION 10.



10. As you tune in a station on your radio receiver, the "S" meter shows no deflection. There is normal audio output. You suspect a problem in the

a. 2nd IF amplifier
b. "S" meter circuit
c. detector
d. 1st IF amplifier

CHECK YOUR RESPONSES TO THIS PROGRESS CHECK WITH THE ANSWER SHEET. IF YOU ANSWER ALL SELF-TEST ITEMS CORRECTLY AND FEEL READY, PROCEED TO THE JOB PROGRAM. IF YOU INCORRECTLY ANSWER ONLY A FEW OF THE PROGRESS CHECK QUESTIONS, THE CORRECT ANSWER PAGE WILL REFER YOU TO THE APPROPRIATE PAGES, PARAGRAPHS, OR FRAMES SO THAT YOU CAN RESTUDY THE PARTS OF THIS LESSON YOU ARE HAVING DIFFICULTY WITH. IF YOU FEEL YOU HAVE FAILED TO UNDERSTAND ALL OR MOST OF THE LESSON, SELECT AND USE ANOTHER WRITTEN MEDIUM OF INSTRUCTION, AUDIO/VISUAL MATERIALS (IF APPLICABLE), OR CONSULT WITH THE LEARNING CENTER INSTRUCTOR, UNTIL YOU CAN ANSWER ALL SELF-TEST ITEMS ON THE PROGRESS CHECK CORRECTLY.

JOB PROGRAM
FOR
LESSON III

IF Amplifiers

INTRODUCTION

This Job Program is designed to further your understanding of IF amplifiers, regarding bandwidth, frequency response, and gain. It should strengthen the important points you studied in the narrative, programmed instruction, and summary.

SAFETY PRECAUTIONS:

Observe all standard safety precautions. Beware of all exposed connections. An energized circuit may have dangerous voltages in it.

EQUIPMENT AND MATERIALS

1. Telonic 1232A Sweep Generator
2. Dual Trace Oscilloscope-NIDA 207 or equivalent
3. RF Detector B & K Model PR-32
4. NIDA 205 Transceiver Trainer-modified version
5. BNC-BNC Cables (3)
6. BNC-Alligator Clip Cable
7. NIDA PC 205-4 FM IF Amplifier Circuit Board
8. NIDA PC 205-5 FM IF Amplifier Circuit Board
9. NIDA PC 205-6 FM Ratio Detector Circuit Board

PROCEDURES

1. Set up the sweep generator as follows:

   a. Sweep frequency dial to "0". Blanking switch "ON".

   b. Sweep width control to mid-range.

   c. Marker width to "wide". Marker size to mid-range.

   d. Sweep mode to "1-50". VERN/MAN control to mid-range.

   e. RF level control fully CW.

   f. Attenuation controls to the "0" position.

   g. All markers switches to the "off" position.

2. Set up the oscilloscope as follows:

   a. All display mode switches out (X-Y mode).

   b. Channel 1 Volts/Div control to .2.

   c. Channel 2 Volts/Div control to 2.

3. Place the MIXER switch on the front panel of the NIDA 205 transceiver down or in the "Out" position. This prevents any interference from the local oscillator from affecting your measurements in the IF amplifier.

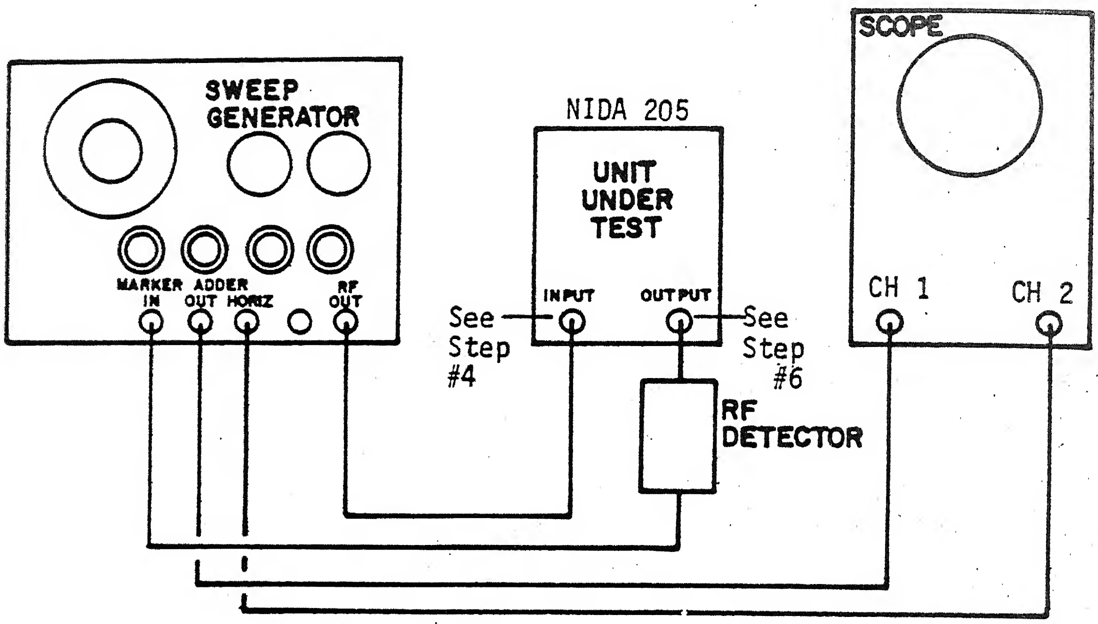


Figure 1

4. Connect the equipment as shown in Figure 1. Connect the RF output from the sweep generator to the IF Input jack on the front panel of the NIDA 205 transceiver.

5. Set up the sweep generator for a frequency of 10.7 MHz as viewed on the oscilloscope.

NOTE: The procedure for this was covered in the job program of lesson Thirty One-2 and since practice was required on your part, step 5 should not be difficult for you.

6. Place the RF detector probe on Pin #11, the output of the 1st IF amplifier assembly.

7. Turn the "0-70" dB attenuator switch on the sweep generator for a 40 dB attenuation of the signal on the scope.

8. Turn the sweep frequency dial until you have centered the freqeuncy response curve on the scope.

   a. Measure the amplitude of the signal on the scope___________.

   b. Using the formula, calculate the amplitude of the signal at the 70.7% power points__________.

9. Turn the RF level on the sweep generator fully CCW.

10. Using the vertical position control on the scope, place the top of the waveform exactly on the center horizontal line.

    a. Using the oscilloscope, measure the amplitude of the signal at the 70.7% power points________. Remember that the full range of the RF level control is 3 dB.

    b. Do steps 8b above and 10a correspond?_________yes/no.

    c. Should they correspond?__________yes/no

11. Turn the RF level control fully CW. Using the sweep width control, expand the sweep. Use the procedure specified in steps 41-43 of Job Program 31-2 to determine the half-power frequencies.

    a. What is the bandwidth?_______________

    b. What is the frequency response?_________________

12. Turn off all the markers.

13. Set the "0-70" dB attenuator switch to 20.

14. Set the channel 1 Volts/Div control to .05. Measure the amplitude of the signal at Pin #3 of the 1st IF amplifier as viewed at the vertical center line of the scope_____________.

15. Set the channel 1 Volts/Div control to .5. Measure the amplitude of the signal at Pin #11 of the 1st IF amplifier____________.

    a. Calculate the gain of the 1st IF amplifier PCB________________.

NOTE: **Certain facts should be noted at this point in the job program.**

1. The transformers are both step-down transformers.

2. 0.6 V is too great an amplitude signal to apply to Q1 in the 2nd IF amplifier without creating distortion.

3. Due to the fact that the 2nd IF amplifier PCB has only one amplifier stage, its gain will be less than the gain of the 1st IF amplifier PCB which has two amplifier stages.

4. The signal at Pin #2 of the 2nd IF amplifier PCB will be the same, in all respects, with the signal at Pin #11 of the 1st IF amplifier PCB.

16. Set the Channel 1 Volts/Div control to .2.

17. Measure the amplitude of the signal at Pin #2 of the 2nd IF amplifier ____________.

18. Measure the amplitude of the signal at Pin #10 of the 2nd IF amplifier using the channel 1 Volts/Div control to decrease the amplitude of the signal____________.

    a. What is the gain of the 2nd IF amplifier?______________.

    b. Using methods previously given in this job program, and counting the markers to the left of the vertical center line determine the bandwidth ____________.

    c. What is the frequency response?_____________.

    d. Is the bandwidth narrower than the BW in step 11?__________yes/no.

NOTE: The remainder of this job program will be concerned with AGC (automatic gain control). On the 1st IF amplifier, notice CR1 and C10; CR1 is the AGC diode and C10 is the AGC capacitor. The AGC voltage is coupled back to the RF amplifier through Pin #2 of the 1st IF amplifier PCB.

19. Connect the equipment as follows:

    a. Sweep generator frequency to 10.7 MHz.

    b. Connect a BNC-alligator clip cable from the "Markers In" jack to the top of C10.

    c. Set the "0-70" attenuator switch to "70 dB" and the "0-10" attenuator switch to "0".

20. Set the controls on the oscilloscope as follows:

    a. Channel 1 Volts/Div control to .2. Set the Ch. 1 AC-DC switch to DC.

    b. Channel 1 vertical position control until a sweep appears at the center of the scope.

21. Change the "0-70" dB attenuator switch in steps of 10 dB until you see the DC level on the scope go in a less positive direction.

NOTE: Notice that from 70 dB to 30 dB the signal was so weak that no AGC voltage was developed since there was no change in the sweep voltage. Notice also that as you changed from 30 to 20 dB the DC level decreased in a less positive direction indicating that AGC voltage is being developed across C10.

22. Turn the attenuator switch to 10 dB. Notice that the DC voltage increased further in a negative direction.

23. Study the schematic diagram at the back of this job program.

    a. What is happening to the base bias of RF amplifier Q1 as the signal strength increases?________________.

    b. Does the signal strength meter confirm your observations in step 24.? ____________yes/no.

    c. Does the RF amplifier use forward or reverse AGC?____________

24. Disconnect all cables from the NIDA 205 Transceiver Trainer.

25. Turn off the power to the Transceiver Trainer.

CHECK YOUR RESPONSES TO THIS JOB PROGRAM WITH THE ANSWER SHEET. IF YOUR RESPONSES AGREE WITH THE ANSWER SHEET, YOU MAY TAKE THE LESSON TEST. IF YOUR RESPONSES DO NOT AGREE OR IF YOU FEEL YOU HAVE FAILED TO UNDERSTAND ALL OR MOST OF THE JOB PROGRAM, REVIEW THE PROCEDURES OF THIS JOB PROGRAM, ANOTHER WRITTEN MEDIUM OF INSTRUCTION, AUDIO/VISUAL MATERIALS OR CONSULT WITH THE LEARNING CENTER INSTRUCTOR UNTIL YOUR RESPONSES DO AGREE.

OVERALL PERFORMANCE TEST INSTRUCTIONS

FOR

TROUBLESHOOTING PERFORMANCE TEST

INTRODUCTION:

Using the following six step troubleshooting procedure will aid you in determining which component is faulty. In the split method of troubleshooting, Pin #11, the output of the 1st IF amplifier assembly, has been selected as the starting point for this performance test. Based on your interpretation of the scope presentation at this point, you can determine which direction you should go.

EQUIPMENT:

1. NIDA 205 Transceiver Trainer
2. Telonic 1232A Sweep Generator
3. NIDA 207 Oscilloscope -Single Trace
4. NIDA PCB's 205-4FM, 205-5 FM and 205-6.
5. Simpson 260 Multimeter and Test Leads
6. RF Detector Probe B&K Model PR-32
7. BNC-BNC cables (2)
8. BNC-Alligator clip cable

INSTRUCTIONS:

1. Each student is required to determine the defective component in a prefaulted IF amplifier circuit board. Although two boards will be provided, only one board will be faulted. Your six-step troubleshooting shhet must indicate you used accurate test measurements and a logical procedure to find the faulty component.

2. Standard test equipment will be available to you in the form of an oscilloscope, a sweep generator, and a Simpson 260 multimeter. You will be expected to observe all safety precautions throughout the test. A safety violation will result in an automatic failure of the performance test. In that event you will be counselled and given remedial training.

TROUBLESHOOTING PERFORMANCE TEST

3. You will take a numbered position in the test room. After briefing by the Learning Center Instructor you will fill out the heading of the troubleshooting form. On a signal from the Learning Center Instructor, you will start the test. If at any time during the test you should require assistance, raise your hand. DO NOT LEAVE YOUR POSITION. A Learning Center Instructor will assist you with your trouble. You will set up the equipment according to the specifications given in the troubleshooting performance test procedures in this booklet. All voltages and resistances measured will be within +/- 20% tolerance with those given in the voltage/resistance chart at the end of this performance test.

4. You must identify the faulty component to pass this performance test.

5. If you do not understand these instructions, raise your hand and ask your Learning Center Instructor. If you do understand these instructions and upon a signal from your Learning Center Instructor, you may now begin the Performance Test on the next page.

NOTE: You may remove the circuit board from the NIDA trainer to make resistance checks.

TROUBLESHOOTING PERFORMANCE TEST

DIRECTIONS: DO NOT WRITE IN THE PERFORMANCE TEST BOOKLET. MAKE ALL YOUR RESPONSES ON THE SIX STEP TROUBLESHOOTING SHEET SUPPLIED WITH THIS TEST PACKET. THIS PERFORMANCE TEST BOOKLET IS DESIGNATED TO AID YOU IN COMPLETING THE STANDARD SIX STEP TROUBLESHOOTING FORM. COMPLETE THE STEPS USING YOUR KNOWLEDGE AND SKILL OF THE CIRCUITS SHOWN. CONTACT YOUR LEARNING CENTER INSTRUCTOR IF YOU HAVE ANY QUESTIONS.

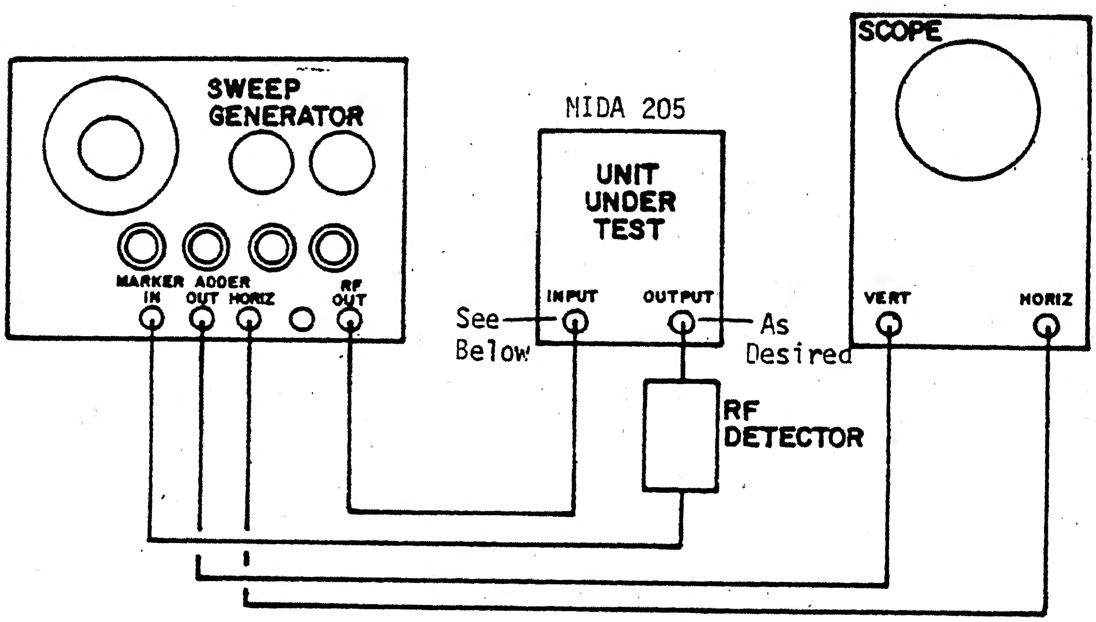


Figure 1

SET UP THE EQUIPMENT AS SHOWN IN FIGURE 1. SET THE SWEEP GENERATOR FOR A FREQUENCY OF 10.7 MHz. CONNECT THE BNC-ALLIGATOR CABLE TO PIN #3 OF THE 1st IF AMPLIFIER. ALL VOLTAGE AND RESISTANCE MEASUREMENTS WILL BE MADE WITH REFERENCE TO GROUND UNLESS THE PCB IS REMOVED TO MEASURE FRONT TO BACK RESISTANCE RATIOS OR TO MEASURE THE RESISTANCE OF A SPECIFIC RESISTOR.

TROUBLESHOOTING PERFORMANCE TEST

STEP ONE - SYMPTOM RECOGNITION

1. Does the equipment energize? ______________________ yes/no.

STEP TWO - SYMPTOM ELABORATION

1. Indication of the Signal Strength meter ___________ yes/no.

STEP THREE - LIST THE PROBABLE FAULTY FUNCTION(S)

1. First and second IF amplifiers

STEP FOUR - LOCALIZE THE FAULTY FUNCTION

1. Isolate the IF amplifier board using the half-split method.

STEP FIVE - LOCALIZE THE FAULTY CIRCUIT/COMPONENT

1. List the test points where actual voltages were taken.
2. What circuit/component in the faulty function listed in step four is faulty?
3. If you have determined the faulty circuit but not the faulty component proceed to part four.
4. Secure power and using the Simpson 260 take resistance checks.
   a. Check front to back ratios on diodes and transistors.
   b. Continuity checks on printed circuit board foil.
   c. Capacitors can be shorted or open.
   d. Resistors can be open.

TROUBLESHOOTING PERFORMANCE TEST

STEP SIX - FAILURE ANALYSIS

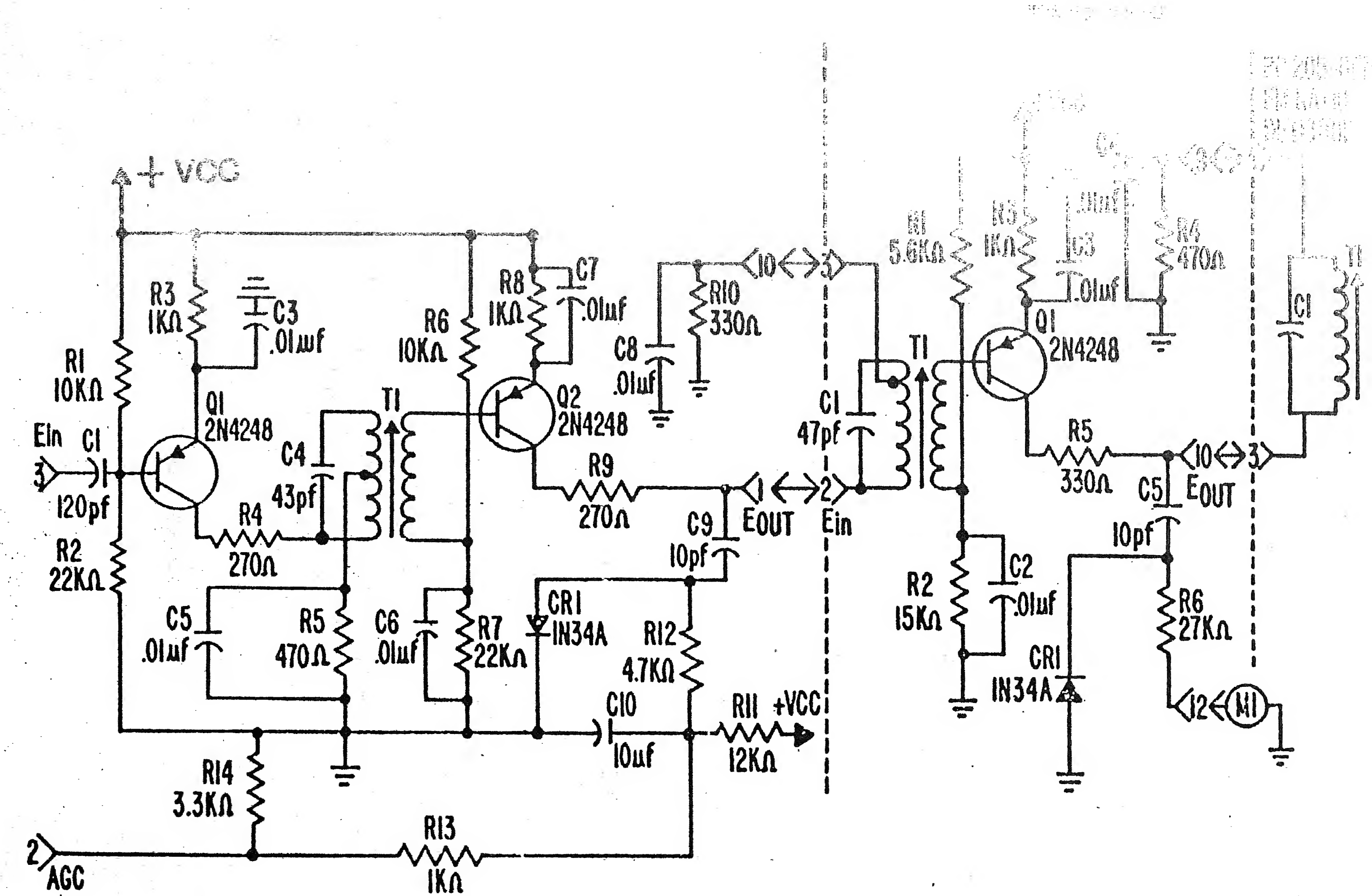
Explain in your own words why the component listed in steps five or six above would cause the symptoms listed in steps one and two of the six step troubleshooting procedure? Write your name in the space provided on the troubleshooting form

TAKE YOUR SIX STEP TROUBLESHOOTING SHEET TO YOUR LEARNING CENTER INSTRUCTOR FOR VERIFICATION AND EVALUATION.

VOLTAGE/RESISTANCE CHART

The following Voltages and Resistances were taken with a Simpson 260 multimeter, with the sweep generator set at 10.7 MHz and connected to Pin #3 of the 1st IF amplifier printed circuit board and the output taken from Pin #10 of the 2nd IF amplifier printed circuit board. All the Voltage and Resistance measurements were made with respect to ground or circuit common.

POINT of CHECK	VOLTAGE	RESISTANCE
Pin #6 Vcc	10.7 VDC	2.1 K ohms
V_E Q1 1st IF	8.2 VDC	3.3 K ohms
V_B Q1 1st IF	7.2 VDC	8.5 K ohms
V_C Q1 1st IF	1.9 VDC	730 ohms
V_E Q2 1st IF	8.5 VDC	3.4 K ohms
V_B Q2 1st IF	7.5 VDC	8.5 K ohms
V_C Q2 1st IF	1.4 VDC	600 ohms
V_E Q1 2nd IF	8.7 VDC	3.4 K ohms
V_B Q1 2nd IF	7.9 VDC	6.0 K ohms
V_C Q1 2nd IF	1.7 VDC	800 ohms



PC 205-4 FM
1st IF AMPLIFIER

PC 205-5 FM
2nd IF AMPLIFIER

306–26

ANSWER SHEET FOR

PROGRESS CHECK

LESSON 3

IF Amplifiers

QUESTION No.	CORRECT ANSWER
1.	c.
2.	a.
3.	a.
4.	b.
5.	b.
6.	d.
7.	c.
8.	b.
9.	d.
10.	b.

ANSWER SHEET
FOR
JOB PROGRAM
LESSON 3

I.F. Amplifiers

8. a. 0.3V
   b. 0.2V

10. a. 0.2V
    b. yes
    c. yes

11. a. 600 kHz
    b. 10.4 MHz to 11.0 MHz

14. 0.015V

15. 0.7V
    a. 47

17. 0.7V

18. 0.7V
    a. 1
    b. 400 kHz
    c. 10.5 MHz to 10.9 MHz
    d. yes

23. a. decreasing
    b. yes
    c. reverse

Tolerance = +/- 20% on all voltage values.

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